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The Genus Hemitrochus in Puerto Rico

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Though the land shells of Puerto Rico are better known than those of other West Indian islands there is still much to be done before the ecology, origin and distribution of its mollusk fauna are understood. This paper began as a routine description of a new species from that island. However, the problem quickly enlarged and produced some rather interesting taxonomic results.

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The species of *Hemitrochus* in Puerto Rico seem to be most closely related to those of Hispaniola. *Hemitrochus dermatina* Shuttleworth of Puerto Rico has a fine dull velvet-like periostracum similar to that of *H. cerosa* Clench and Aguayo from La Viste, La Selle Range, Haiti. This is a very rare condition in this group, in fact these two species are the only ones now known to possess this character, and so it might indicate that these two species had a common origin. The remaining four species in Puerto Rico seem to be most closely related to an undescribed species from Hispaniola.[1] This is particularly true of *Hemitrochus clenchi* Turner which has a similar shape and color pattern. *Hemitrochus anguliferus* von Martens and *H. riveroi* Turner are most closely related to *H. clenchi* of Puerto Rico and probably had their origin on the island. Though we now know the anatomy of four of the Puerto Rican species none of the Hispaniola species has been studied and so comparisons can be made only on the basis of shell and radular characters. These indicate a much closer relationship within this group of species than any of the species have to those from Cuba, Jamaica, the Bahamas or elsewhere in the range of the genus. This relationship of Puerto Rican and Hispaniolan species agrees with findings in other groups and is supported by the known geology of the area.

There has been considerable confusion in the literature concerning the status of *Hemitrochus* and particularly the name of the family to which it belongs. *Hemitrochus* was introduced by Swainson in 1840 as a subgenus of *Geotrochus* which was included in the family Helicidae. In the Manual of Conchology (2) **5,** 1889, Pilsbry considered *Hemitrochus* a subgenus of *Helix* in the family Helicidae. Later it was considered a subgenus of *Cepolis* Montfort 1810 and for a time was variously placed as a subgenus of *Cepolis,* or of *Helix,* or as a section of the subgenus *Cepolis* in the genus *Helix.* Then, as anatomical studies led to the division of the large family Helicidae, the genus *Cepolis* was firmly established and in Manual of Conchology (2) **9,** 1894 Pilsbry considered *Hemitrochus* a subgenus of *Cepolis.* Recent authors have considered *Hemitrochus* a subgenus

[1] W. J. Clench, New Land Shells from Hispaniola in the Families Camaenidae and Fruticicolidae, to be published probably in 1958.

of *Cepolis* or as a full genus. Consequently, in tracing the name of the family to which this group belongs, the genus *Cepolis* becomes important, as in the early definitions of the families concerned the name *Hemitrochus* seldom appeared.

In 1923 Wenz instituted the family name Eulotidae based on the genus *Eulota* Hartmann 1843 and including the genera *Cepolis, Oreohelix* Pilsbry and *Epiphragmophora* Doring. Lindholm (1927), following Article 5 of the International Rules of Zoological Nomenclature, used the family name Fruticicolidae, as the genus *Eulota* Hartmann 1843 is a synonym of *Fruticicola* Held 1837. The type species of each is *Helix fruticum* Müller.[1] Hoffman in 1928 used the family name Eulotidae and divided the family into six subfamilies, introducing the subfamily Cepolinae for the genera *Cepolis* Montfort, *Polymita* Beck and *Averellia* Ancey. Thiele (1931) followed Lindholm, using the family name Fruticicolidae, and this name has been used generally by European authors since that time. In 1934, Pilsbry, in the Proceedings of the Malacological Society of London **21,** p. 47, showed that *Bradybaena* Beck was a prior name for *Fruticicola* Held, and consequently, in another paper published the same year (1934, p. 7), he instituted the family Cepolidae based on the senior genus *Cepolis* Montfort 1810, and placed the Asiatic genera in the subfamily Bradybaeninae. Following this the family name Cepolidae was generally used by American authors. In 1939, Pilsbry, realizing that the name Cepolidae was preoccupied in fishes based on the genus *Cepola* Linné (A. Gunther 1861, Catalogue of the Fishes in the British Museum **3,** p. 486), proposed the name Bradybaenidae for "Eulotidae of authors and Fruticicolidae Lindholm." However, for the American and West Indian species he created the family Helminthoglyptidae comprising the subfamilies Cepoliinae, Helminthoglyptinae, Sonorellinae and Humboltianinae. In his description of the Helminthoglyptidae, Pilsbry mentioned *Xanthonyx* Crosse and Fischer, and *Metostracon* Pilsbry 1900, as genera in this family in which the shell is more or less de-

[1] *Fruticicola* Held 1837 [in] Isis von Oken, p. 914 (type species, *Helix fruticum* Müller, by tautonomy and subsequent designation Herrmannsen 1847, p. 450). Not *Fruticicola* as used by von Martens and others.

Eulota J. D. W. Hartmann 1843, Erd-und Susswasser Gasteropoden der Schweiz, St. Gallen, p. 179 (type species, *Helix fruticum* Müller, by monotypy).

generate. Now, to climax this confused family taxonomy, H.B. Baker (1956) has pointed out that if the law of priority is to be applied to family names, this group should probably be called Xanthonycidae Strebel and Pfeffer 1879. This name was based on the above-mentioned aberrant genus *Xanthonyx* which, on the basis of anatomy, is now considered close to the cepolids, but at the time Strebel and Pfeffer were publishing, it was thought so different that it was placed in a separate family.

One fact should be strongly apparent from the above discussion, and that is, the limits and status of the families of this area of the pulmonate land mollusca are far from being settled. None of the families mentioned above, all of which include the genus *Cepolis,* are exactly equivalent, for each contains at least one genus not included in the others. In attempting to decide upon the proper family name for *Hemitrochus* two problems are evident. First, how much should this area of the Pulmonata be split up and second, what name will be best understood and cause the least confusion. If the divisions are small enough there will be a family name for each zoogeographic region, i.e., Bradybaenidae for Asia, Fruticicolidae for Europe and Helminthoglyptidae for the Americas — perhaps this is the easiest solution. However, when families become too small they have little meaning, and many valuable relationships are lost. It then becomes necessary to work on the superfamily or order level when considering world distribution patterns. Therefore it seems best, at least at the present time, to be more conservative, recognizing one family with several subfamilies. Since *Bradybaena* is now restricted to the Asiatic species and *Fruticicola* is used as the generic name for the European species, there is no longer any problem concerning the family name Fruticicolidae. The problem now is to decide between Fruticicolidae, a name which has been in use since 1927, and Xanthonycidae, a name which has never been used but was instituted in 1879 for an aberrant genus which is now included with the cepolids. It seems most unwise to change the name of an entire group to this family name based on a genus which may again be separated from the main group. Consequently, I am using the name Fruticicolidae more or less as limited by Thiele with the subfamily Helminthoglyptinae for the American and West Indian species.

Family **Fruticicolidae** *Lindholm*

Shells ranging in size from about 5 mm. to 75 mm. in greatest diameter; globose, trochoid or lenticular in shape, but degenerate in *Xanthonyx* Strebel and Pfeffer and *Metostracon* Pilsbry. Lip narrow, slightly to moderately expanded and usually reflected. Apertural armature usually lacking, but present in some forms as a small tooth on the basal lip (*Plagioptycha*), a thickening on the parietal lip (*Jeanneretia*), or as a gular fold (*Jeanneretia, Cepolis*). Shell umbilicate or imperforate, the umbilicus varying greatly in size. Color pattern extremely variable, ranging from highly colored *Polymita* to uniform brown *Plagioptycha.* The color pattern may consist of from one to many spiral bands of varying widths and color or of axial flames or of a combination of both.

Radula with the central and inner lateral teeth usually without cusps. Jaws ribbed or smooth.

Reproductive system having a dart sac or sacs, with one or two mucous glands which are globular, club-shaped or irregular, not tubular or digitate as in the Helicidae. Spermatheca nearly circular, oval or oblong, and usually with a long duct which is never branched, as in the Helicidae. Penis with an epiphallus and flagellum.

The anatomical drawings made for this paper have been arranged similarly to those of H. B. Baker so that comparisons can be made with his work. Even a casual survey of anatomical literature on land mollusks shows a great lack of uniformity both in the arrangement of the organs and in the illustrations and in their labeling. Consequently, it is often difficult to compare various works with any degree of certainty.

Genus **Hemitrochus** *Swainson*

Hemitrochus Swainson 1840, Treatise on Malacology, pp. 165 and 331.

Phaedra Albers 1850, Die Heliceen, p. 100 (type species, *H. varians* Menke, here selected).

Polytaenia von Martens 1860, Die Heliceen, p. 129 (type species, *Helix multifasciata* Weinland and von Martens, by monotypy).

Type species, *H. haemastoma* Swainson [=*H. varians* Menke], by monotypy.

Shell small to medium in size, reaching 15 to 20 mm. in greatest diameter, depressed-globose to trochoid, fragile to

rather solid in structure, and usually having spiral bands of color. Umbilicus lacking or very small. Aperture without teeth and descending slightly. Lip simple, narrow and slightly reflected. Jaw smooth or nearly so.

In his outline of the Antillean helicids, H. B. Baker (1943, p. 82) considers *Hemitrochus* a subgenus of *Cepolis* and recognizes four sections in *Hemitrochus* and seven in *Cepolis* s.s. On the basis of shell characters *Hemitrochus* appears to be worthy of generic rank, particularly when the differences in shell characters are combined with those of the radula and soft parts as noted by Baker.

In Puerto Rico there are five species in the genus *Hemitrochus* all of which appear to be rather rare.

Hemitrochus dermatinus *Shuttleworth*

Plate 23, figs. 1–2; Plate 24, figs. 1–2

Helix dermatina Shuttleworth 1854[1] Mittheilungen der Naturforschenden Gesellschaft in Berne, nos. 314–316, p. 41 (Luquillo, Puerto Rico), non *H. dermatina* of authors.

Description. Shell globose-trochiform, fragile, finely sculptured, imperforate, and with a definite though not pronounced keel at the whorl periphery. Color a golden-brown with a narrow spiral band of red-brown above the keel, and a slightly broader one below. Whorls 5, slightly convex both above and below the keel. Spire extended and produced at an angle of about 85°. Aperture ovate, depressed downward and produced at an angle of about 50° from the base. Palatal lip thin, narrow, reddish brown in color and slightly reflected. Parietal area very lightly glazed. The area at the base of the columella a reddish brown. Columella short, slightly thickened and curving into the base of the outer lip. Suture slightly impressed. Axial sculpture consisting of fine growth lines. Spiral sculpture consisting of 8 to 10 fine threads above the keel and 10 to 12 below the keel. The crossing of the axial growth lines and the

[1] Pfeiffer, Pilsbry and others have referred to the original description of this species as in "Diagnosen Neuer Mollusken, no. 6, p. 133, 1854." The Diagnosen Neuer Mollusken was a collection of Shuttleworth papers which were renumbered and repaged, but the originals appeared in the Mittheilungen der Naturforschenden Gesellschaft in Berne.

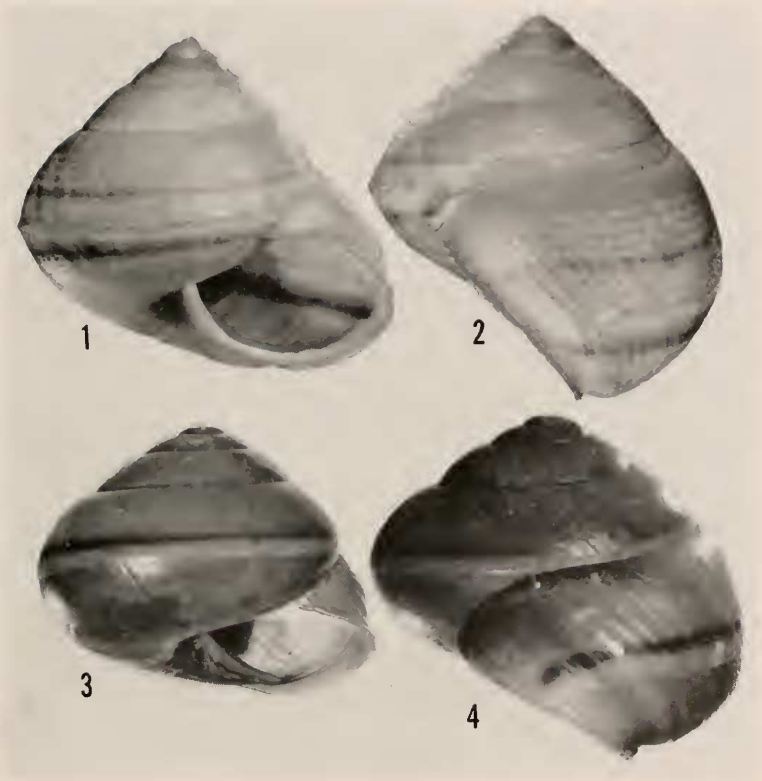


Plate 23

Figs. 1–2. Lectotype of *Helix dermatina* Shuttleworth from near Luquillo, Puerto Rico (3.4x).

Figs. 3–4. Holotype of *Hemitrochus clenchi* Turner from the Maricao Forest, Puerto Rico. Fig. 3 (2.84x). Fig. 4 (3.4x).

spiral threads gives the shell a somewhat reticulated appearance under magnification. Embryonic whorls $1\frac{1}{2}$, smooth and papilliform. Periostracum thin, dull, golden-brown in color, and with a fine velvety texture.

greater diameter	lesser diameter	height	whorls	
15 mm.	14 mm.	14 mm.	5	Lectotype
13.5	12.5	12	$4\frac{3}{4}$	Paratype

Types. The lectotype of *Helix dermatina* Shuttleworth, here selected, is in the Natural History Museum, Berne, Switzerland, Blauner, no. 111. The type locality is "near Luquillo, Puerto Rico," B. F. Blauner, collector. Two paratypes from the same locality are also in the Berne Museum.

Remarks. This species has long been misunderstood. It was not figured by Shuttleworth and apparently subsequent workers did not refer to the type specimens. Through the kindness of Dr. W. Kuenzi, Director of the Berne Natural History Museum I have had the loan of the type lot of *Helix dermatina* for study and figuring. This species from the eastern tip of the island is certainly different from the species which has generally been called by this name. *Hemitrochus dermatinus* differs from other species in this genus by its papilliform embryonic whorls, its dull and slightly velvety periostracum, its pronounced spiral sculpture and the reddish brown coloration at the base of the columella. *Hemitrochus riveroi* Turner, which also has a pronounced spiral sculpture, is a much larger and more strongly keeled species, and lacks the velvety periostracum of *dermatinus.* From the keeled specimens of *H. clenchi* which it most closely resembles it differs in its more extended and acute spire, in addition to other characters mentioned above. See also remarks under *H. clenchi.*

This is a very rare species and apparently has not been collected since Blauner found it on a banana plant near Luquillo, Puerto Rico. It seems safe to assume that Blauner collected this species in the lowlands near the town of Luquillo, for Shuttleworth in his paper referred to the Sierra de Luquillo when describing species that were collected in the mountains.

Specimens examined. Near Luquillo (Nat. Hist. Mus. Berne).

Hemitrochus clenchi, new species
Plate 23, figs. 3–4; Plate 24, figs. 7–8; Plate 25; Plate 30, fig. 2

Cepolis dermatina of authors, not of Shuttleworth 1854.

Description. Shell globose, fragile, with only a slight indication of a keel in occasional specimens, smooth and imperforate. Color a light straw-yellow to medium red-brown with a narrow band of dark brown just above the periphery, a yellow band at the periphery, and occasional specimens with an additional brown band just below the periphery. Whorls 5, moderately convex, and occasionally slightly keeled, but with the periphery becoming rounded about $1\frac{1}{4}$ whorl before the lip is formed. Spire somewhat depressed and produced at an angle of about 95°. Aperture ovate, depressed downward and produced at an angle of about 45° from the base. Palatal lip thin, narrow, very slightly reflected and white to pink or lavender in color. Parietal area thinly glazed. Columella short, slightly thickened and curving into the base of the outer lip. Suture slightly impressed. Axial sculpture consisting of extremely fine growth lines. Spiral sculpture when seen with a 14x lens consisting of exceedingly fine, interrupted threads. Periostracum thin, smooth and glossy. Embryonic whorls $1\frac{1}{2}$, depressed and smooth.

greater diameter	lesser diameter	height	whorls	
17 mm.	15 mm.	13 mm.	5	Maricao Forest
16.5	15	12.5	5	20 km. SW. of Arecibo
15	13.5	11.5	5	10 km. W. of Utuado
15	12.5	10	$4\frac{3}{4}$	Guajataca Ranger Station
14	12	10.8	$4\frac{3}{4}$	" " "

Types. The holotype from the Maricao Forest, Puerto Rico is in the Museum of Comparative Zoölogy, no. 216146.

Remarks. It is surprising that this, the most common species of *Hemitrochus* in Puerto Rico, should be without a name. It has always been confused with *dermatinus* Shuttleworth, because the original description of *dermatinus* was rather brief and the species was never figured. This is understandable, even though Shuttleworth did mention the subpapilliform embryonic whorls and the spiral sculpture. An examination of the type lot of *dermatinus* showed immediately that two spe-

Plate 24

Embryonic whorls in *Hemitrochus*.

Figs. 1–2. *Hemitrochus dermatinus* Shuttleworth. Lectotype.

Figs. 3–4. *Hemitrochus anguliferus* von Martens, 1 mile from Adjuntas on road to Guazas, Puerto Rico.

Figs. 5–6. *Hemitrochus riveroi* Turner, Holotype.

Figs. 7–8. *Hemitrochus clenchi* Turner, Holotype.

All drawings made with the aid of a camera lucida.

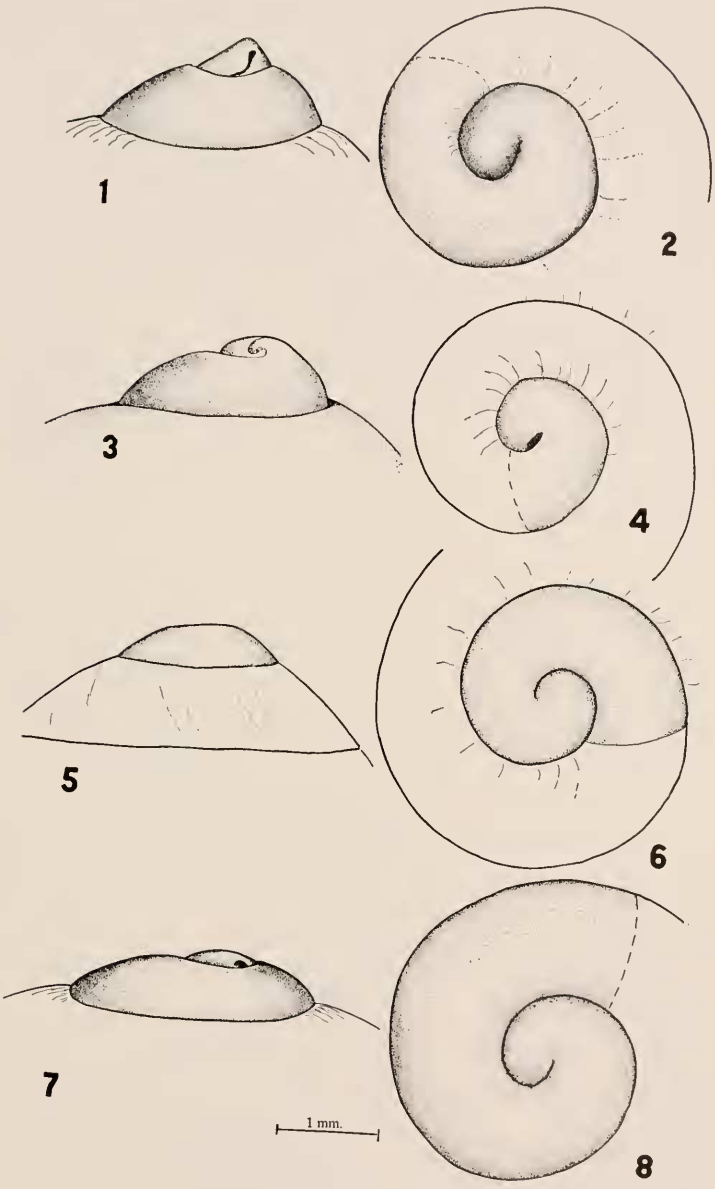


Plate 24

cies were involved. *Hemitrochus clenchi* is readily distinguished from *H. dermatinus* Shuttleworth by its more globose shape, greater spire angle, its shining periostracum, its extremely fine sculpture and large, depressed embryonic whorls. From *H. anguliferus* von Martens, which has also been confused with *clenchi,* it differs by having rounded rather than strongly keeled whorls. Those specimens of *clenchi* which produce a slight keel become rounded about $\frac{1}{4}$–$\frac{1}{2}$ whorl before the lip is produced, while in *anguliferus,* the keel continues to the lip. In addition, *clenchi* has larger, more depressed embryonic whorls, the lip is usually pink or lavender rather than white, and the spiral sculpture is absent or extremely fine.

The anatomy of the reproductive system of *clenchi* is figured on Plate 25. It differs from *anguliferus* in having only four lobes to the ovotestis, in having the spermatheca nearly globular, the sheath glands larger and in other details as shown in the illustration. In anatomical details it seems to be more closely related to *H. boriquenus* Baker.

Specimens examined. Maricao Forest at about 2000 feet (MCZ); Trail N of Guajataca Ranger Station; Guajataca Forest Station; 15 km. S of Arecibo; 20 km. SW of Arecibo on road to Lares; 10 km. W of Utuado on road to Lares; 9 km. NE of Jayuya; 15 km. NW of Ponce on road to Adjuntas; Barrio Rucio, near Peñuelas (all U of M).

Hemitrochus boriquenus *H. B. Baker*

Plate 26

Helix diaphana Lamarck 1822, Histoire Naturelle des Animaux sans Vertèbres **6,** (2) p. 85 (l'ile de Ténériffe, Maugé); Deshayes 1858 [in] Lamarck ibid., 2nd. ed. **8,** p. 62; non *H. diaphana* Poriet 1801.

Helix diaphana Lamarck. Pfeiffer 1847, Monographia Heliceorum Viventium **1,** p. 281 (Rio Janeiro, Mus. Berol.).

Helix diaphana Lamarck. Férussac and Deshayes 1850, Histoire Naturelle des Mollusques **1,** p, 222, pl. 104, fig. 1 (l'ile de Ténériffe).

Helix diaphana Lamarck. Shuttleworth March 1854, Mittheilungen der Naturforschenden Gesellschaft in Berne, nos. 314–316, p. 39 (San Juan and Humacao, Puerto Rico, Blauner).

Helix diaphana Lamarck. Reeve July 1854, Conchologia Iconica **7, Helix,** pl. 188, species 1312 (Island of Puerto Rico, West Indies, Blauner).

Helix diaphana (Lamarck) Pfeiffer. Pilsbry 1889, Manual of Conchology (2) **5,** p. 22, pl. 19, figs. 51–52 (Porto Rico; Viéque).

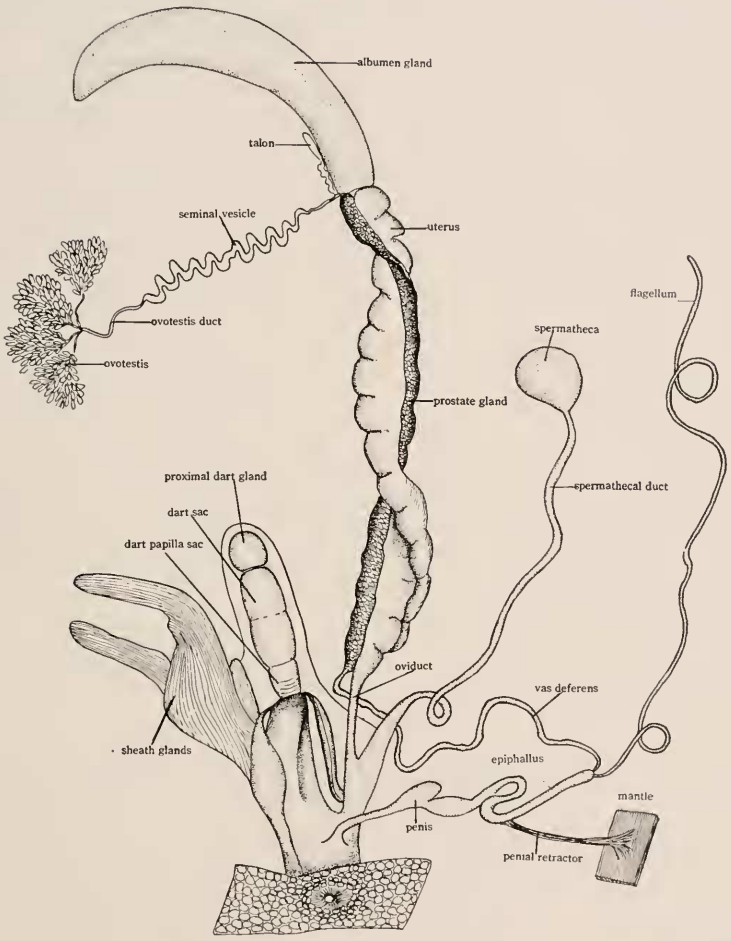


Plate 25

Anatomy of the reproductive system of *Hemitrochus clenchi* Turner (about 4½x).

Cepolis (*Plagioptycha*) *boriquenae* H. B. Baker 1940, Nautilus **53,** p. 107 (new name for *Helix diaphana* Lamarck, Pilsbry 1889; non Poriet 1801).

Cepolis (*Levicepolis*) *boriquenae* H. B. Baker 1943, Nautilus **56,** pp. 82 and 88, pl. 9, fig. 6.

Cepolis boriquenae Baker. van der Schalie 1948, Miscellaneous Publications Museum of Zoology, University of Michigan, no. 70, p. 85, pl. 6, fig. 14.

Description. Shell globose, fragile, smooth, shining and imperforate. Color a light straw-yellow to rich golden brown with occasional specimens having a spiral band of brown at the periphery. Columellar area a conspicuous china-white. Whorls 4 to $4\frac{1}{4}$, slightly convex. Spire depressed, obtuse and produced at an angle of about 105°. Aperture ovate, depressed slightly downward and produced at an angle of about 50° from the base. Palatal lip thin, narrow and with a very slight reflection at the basal and outer portion. Parietal area thinly glazed. Umbilical area deeply indented, the columella truncate in young specimens. In adult specimens the columella margin is reflected and slightly thickened and curved into the base of the outer lip. Suture slightly impressed. Axial sculpture consisting of exceedingly fine growth lines which are best seen under 10x magnification. Spiral sculpture lacking. Periostracum thin, smooth and glossy. Embryonic whorls 1 to $1\frac{1}{4}$, depressed and smooth.

greater diameter	lesser diameter	height	whorls	
14 mm.	12.5 mm.	9.5 mm.	$4\frac{1}{2}$	Loiza, Puerto Rico
13	11.5	9	4	" " "

Types. The type of *Helix diaphana* Lamarck may possibly be in the Paris Museum. See discussion under *Remarks.* H.B. Baker designated a holotype (ANSP no. 28335) and paratypes (ANSP no. 226299) for his *C. boriquenae,* based upon the specimens Pilsbry had used in describing *H. diaphana* 'Lamarck' Pilsbry (loc. cit.). However, if time proves that Lamarck's *diaphana* is not the Puerto Rican species, the actual type specimens of *boriquenae* should be specimens of Shuttleworth who first described this species from known Puerto Rican specimens. In essence, Baker's introduction of the name *boriquenae* was only a change of names for a homonym, *H. diaphana* Lamarck 1822, non Poriet 1801.

Remarks. There has been some question about the identity of *Helix diaphana* Lamarck based on the facts that Lamarck's description was inadequate and the locality given was Ténériffe. This locality was apparently in error. Lamarck states that the species was collected by Maugé, and though Maugé had been on Ténériffe he had also been in Puerto Rico. According to Ledru (1810) Maugé was the zoologist on the voyage to Ténériffe, La Trinite, St. Thomas, St. Croix and Puerto Rico under the direction of Captain Baudin. Gundlach (1883) and Fischer (1892) also state that the naturalists Maugé and Krauss sent material from Puerto Rico to Lamarck. In fact, Lamarck (1822) lists a number of species from that island collected by Maugé. Therefore the chances of an error were great.

Férussac (1822) in the Corrections et Additions of his "Tableaux Systematique des Animaux Mollusques" (often referred to as his Prodrome), p. 69, no. 319 bis, gives "*diaphana,* Lamarck, communicavit. Habit.? Cabinet de M. de Lamarck." Plate 104, fig. 1 of Férussac and Deshayes, "Histoire Naturelle des Mollusques," Atlas **2,** figures a shell which certainly appears to be the Puerto Rican species. This plate according to Bourguignat (1925) was published in 1822. The description by Férussac and Deshayes in the Histoire **1,** p. 222, was not published until 1850. It is very probable that Férussac borrowed Lamarck's specimen to figure it as implied by his "communicavit" mentioned above. The fact that Deshayes worked with both Férussac and Lamarck makes this seem even more likely. It also agrees with the fact that Mermod (1951) states that Lamarck had only one specimen of *diaphana* in his collection, that it is not in the museum at Geneva and that it was probably lost before the Lamarck collection was transferred to Geneva. The Férussac collection is in the Paris Museum according to Sherborn (1940) and it is likely that Lamarck's type of *diaphana* may be there.

Shuttleworth was apparently the first to apply the name *diaphana* to specimens known to come from Puerto Rico. This was from the material collected by Blauner which was also described and figured by Reeve. The name *diaphana* was used for the Puerto Rican species from 1854 until 1940 when H. B. Baker introduced the name *boriquenae* for *Helix diaphana* Lamarck as used by Pilsbry in 1889, non *H. diaphana* Poriet

Plate 26

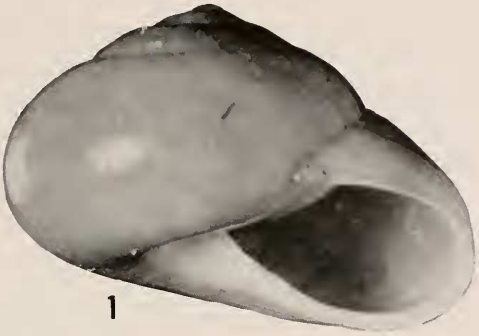
Hemitrochus boriquenus H. B. Baker

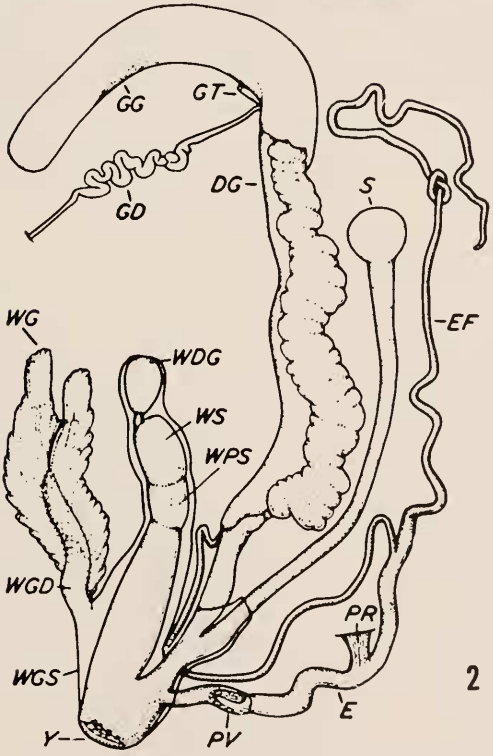
Fig. 1. Loiza, Puerto Rico. Specimen selected by Baker as the holotype of *boriquenae,* ANSP 28335 (4.6x).

Fig. 2. Anatomy of the reproductive system. This figure was copied from Baker, 1943, Nautilus **56,** pl. 9, fig. 6 (about 4x).

Fig. 3. Radula of a juvenile specimen from Arecibo, Puerto Rico.

The 1/10 mm. refers only to the radula.





1/10 mm.

Plate 26

1801. He gave no synonymy but restricted his name to the description and figures of Pilsbry which were based on material collected by Swift at Loiza, Puerto Rico. From the above discussion it seems reasonably certain that Lamarck was dealing with the Puerto Rican species and that the locality was in error. Therefore, *boriquenae* is simply a change of name rather than a new species as indicated by Baker. See also discussion under *Types.*

This species is most closely related to *H. clenchi* from which it differs in being smaller, more depressed, having fewer whorls, and in lacking completely even microscopic spiral sculpture. In addition, the umbilical area is deeply indented, and the columellar margin is reflected to form a slight callus which is a conspicuous china-white.

The reproductive anatomy of the two species is similar as is shown in the illustrations. Baker (1943) provisionally placed his *dermatina* [=*angulifera*] in *Jeanneretia.* He created the subgenus *Levicepolis* for *boriquenae* stating that this species was more arboreal than typical *Plagioptycha,* the subgenus in which he had formerly placed it. However, in his remarks he mentions the similarity of the anatomy of these two species and states that "*dermatina* [=*angulifera*] seems fairly closely related to *C. boriquenae* and may be nearer *Levicepolis* than the Cuban *Jeanneretia.*" The anatomy of *boriquenae* is even closer to that of *clenchi,* and both are close to *riveroi* and *angulifera.* Therefore, with the possible exception of *dermatina* Shuttleworth, the anatomy of which is unknown, all of these species probably belong in the subgenus *Levicepolis.*

Although it has a wide range, particularly in the eastern and northern parts of the island, this is not a common species. Most records are from low altitudes though the species has been found in the mountains. Van der Schalie (1948) indicated 26 localities for this species on his distribution map.

Specimens examined. Loiza (ANSP); Barceloneta (USNM); Cambalache Forests; Areciba; Vieques Island (all MCZ).

Hemitrochus anguliferus *von Martens*

Plate 24, figs. 3–4; Plate 27, figs. 3–4; Plate 28; Plate 30, fig. 1

Helix (*Thelidomus*) *angulifera* von Martens 1877, Jahrbücher der Deutschen Malakozoologischen Gesellschaft **4,** p. 347, pl. 12, fig. 2.

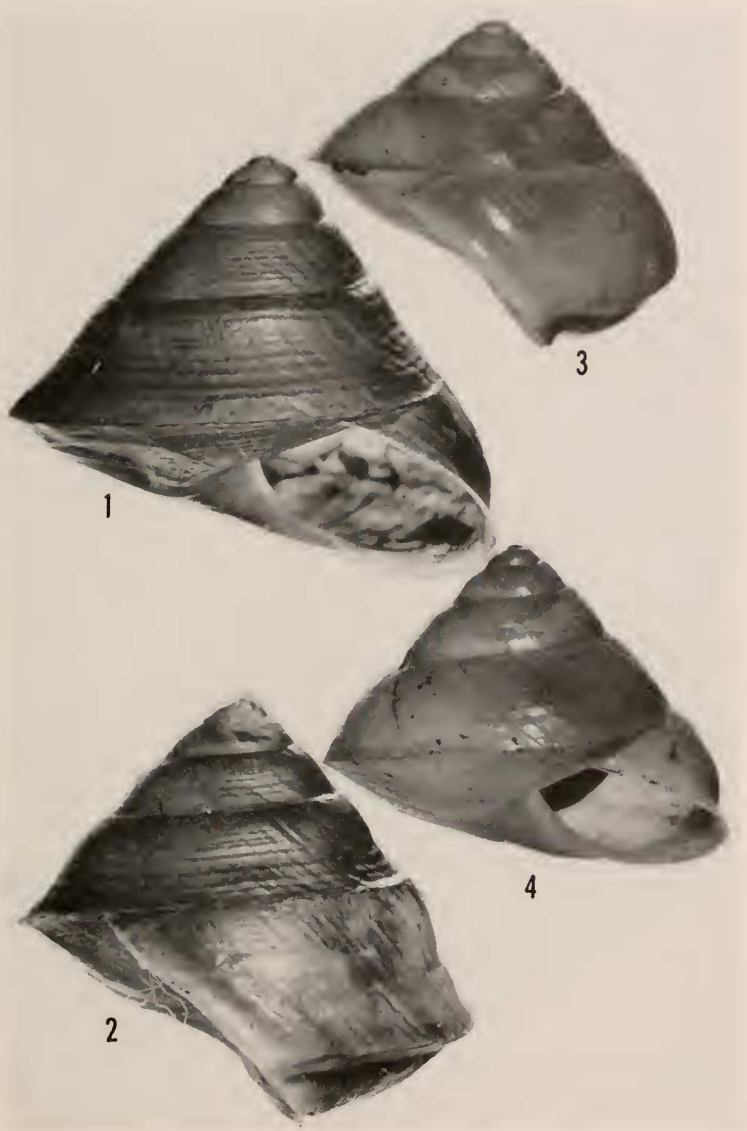


Plate 27

Figs. 1–2. *Hemitrochus riveroi* Turner, from Doña Juana, Toro Negro National Forest, Puerto Rico. Fig. 1, Holotype; Fig. 2, Paratype (3.4x).

Figs. 3–4. *Hemitrochus anguliferus* von Martens, 1 mile from Adjuntas on the road to Guazas, Puerto Rico (3.4x).

Cepolis (Jeanneretia ?) dermatina 'Shuttleworth' H. B. Baker 1943, Nautilus **56**, p. 88, pl. 11, figs. 19–21.

Description. Shell trochiform, fragile, keeled, smooth to very finely sculptured and imperforate. Color a light straw-yellow with a single red-brown band just below the periphery on the body whorl of most adult specimens. Whorls 5, slightly convex and keeled. Spire extended and produced at an angle of about 85°. Aperture ovate, slightly descending and produced at an angle of about 48° from the base. Palatal lip thin, narrow, white and very slightly reflected. Parietal area thinly glazed. Columella very short, slightly thickened and curving into the base of the outer lip. Suture slightly impressed. Axial sculpture consisting of inconspicuous growth lines. Spiral sculpture consisting of fine, irregular, and interrupted threads which are best seen with transmitted light. Embryonic whorls 1, and smooth. Periostracum very thin, smooth, glossy and pale yellow in color.

greater diameter	lesser diameter	height	whorls	
17 mm.	15 mm.	12.5 mm.	5	1 mile from Adjuntas
17	15	12	5	" " "
15.5	13.5	11	5	" " "
15	13.5	11.5	5	" " "

Types. The type specimens of *H. angulifera* von Martens are in the Berlin Museum according to Gundlach (1883). However, in a recent letter, Professor S. Jaeckel of the Berlin Museum informed me that they have been unable to locate them. The type locality as given by von Martens was "An der Westküste von Puertorico südlich von Mayagüez" that is, the west coast of Puerto Rico, south of Mayagüez. However, Gundlach in his Apuntes para La Fauna Puerto-Riqueña (1883) stated: "Despues visité á Yayuya [Jayuya] á distancia de algunas leguas en direccion ESE de Utuado, pasando por el pié de la Sierra de Morales, donde Hjalmarson ha descubierto el *Chondropoma terebra* Pfr. Allí encontré una especie nueva de *Helix,* la *angulifera* von Mart." [Afterward I visited Yayuya a distance of some leagues ESE of Utuado, passing by the foot of the Sierra de Morales, where Hjalmarson discovered the *Chondropoma terebra* Pfr. There I found a new species of *Helix,* the *angulifera* von Mart.] This statement by Gundlach, who col-

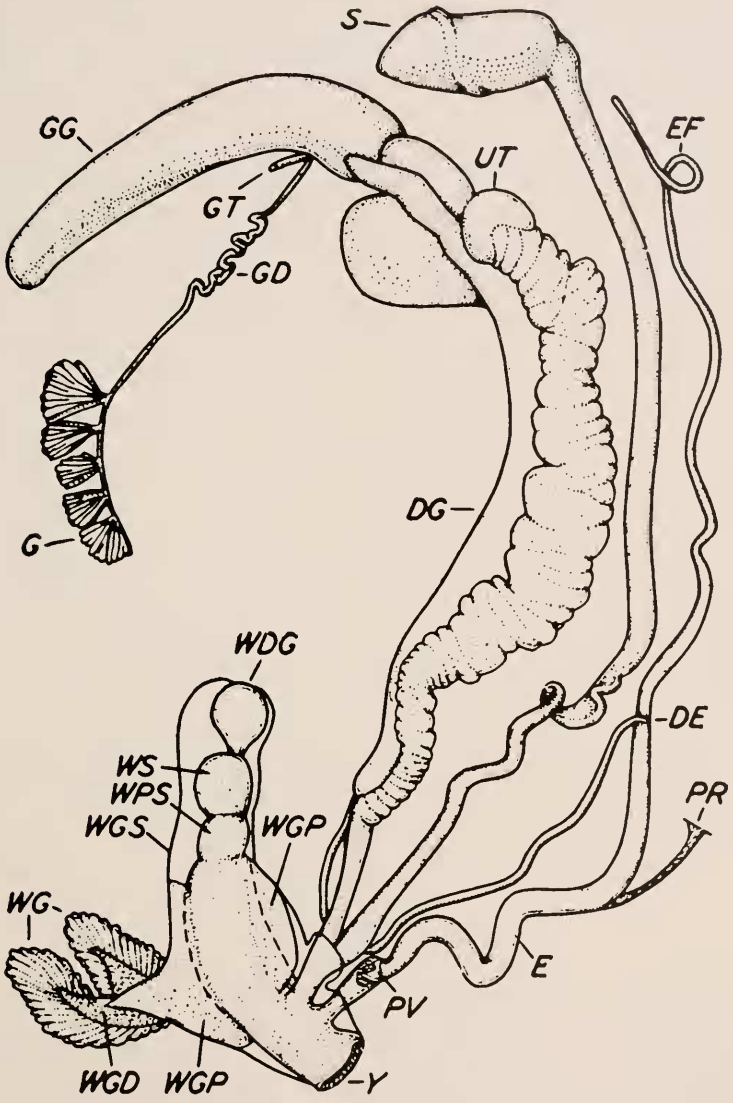


Plate 28

Anatomy of the reproductive system of *Hemitrochus anguliferus* von Martens.

This plate was copied from H. B. Baker, Nautilus **56**, pl. 11, fig. 19, where he published it under the name of *Cepolis* (*Jeanneretia?*) *dermatina* Shuttleworth. The shell from which the soft parts were taken is shown on Plate 27, figs. 3–4 (about 5x).

lected the original material and sent it to von Martens, places the type locality in the central portion of the island and in the same general type of country where H. B. Baker collected his specimens.

Remarks. This is apparently quite a rare species. It has been confused with *H. dermatinus* Shuttleworth and *H. clenchi* Turner. It differs from *clenchi* in having a trochiform rather than globose shell, in having the columella and lip white and the periphery keeled. From *H. riveroi* Turner it differs in being much smaller, in having the whorls slightly convex rather than concave above the periphery and in having much finer spiral sculpture. See also remarks under *dermatinus* and *clenchi.*

The specimens figured (Plate 27, figs. 3–4) are the ones from which H. B. Baker (1943, Nautilus **56,** p. 88, pl. 11, figs. 19–21) figured the anatomy of the reproductive system under the name of *Cepolis dermatina* Shuttleworth. The anatomy as figured by Baker is very close to that of *H. riveroi* but differs in having the spermatheca larger and the spermatheca duct proportionately much longer. The dart sac of *riveroi* is nearly twice as long as the proximal dart gland while in *anguliferus* they are about of equal length.

Specimens examined. 1 mile from Adjuntas on road to Garzas (ANSP); Finca Pagán, 19 km. NW of Ponce; km. 21 on road from Ponce to Adjuntas (both U of M).

Hemitrochus riveroi,[1] new species
Plate 24, figs. 5–6; Plate 27, figs. 1–2; Plate 29; Plate 30, figs. 3–6

Description. Shell trochiform, fragile, sharply keeled, finely sculptured, and imperforate. Color a uniform, medium golden to olivaceous brown with a single dark brown band just below the periphery. In some specimens there is an indication of an additional brown band just above the keel. Whorls $5\frac{1}{4}$, nearly

[1] It is a pleasure to name this species in honor of Dr. Juan Rivero, Director of the Institute of Marine Biology, University of Puerto Rico, Mayagüez, Puerto Rico.

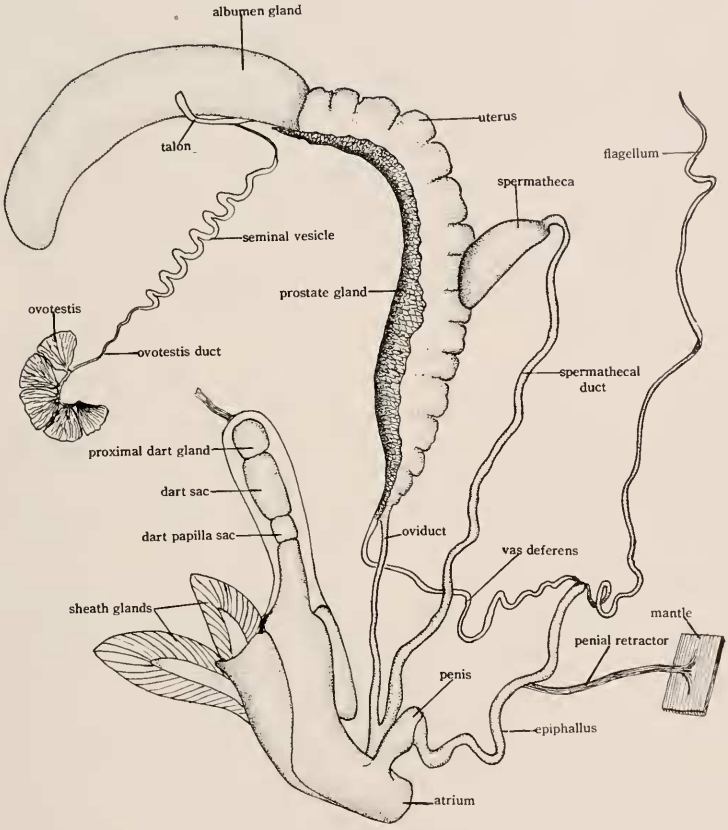


Plate 29

Anatomy of the reproductive system of *Hemitrochus riveroi* Turner (about $4\frac{1}{2}$x).

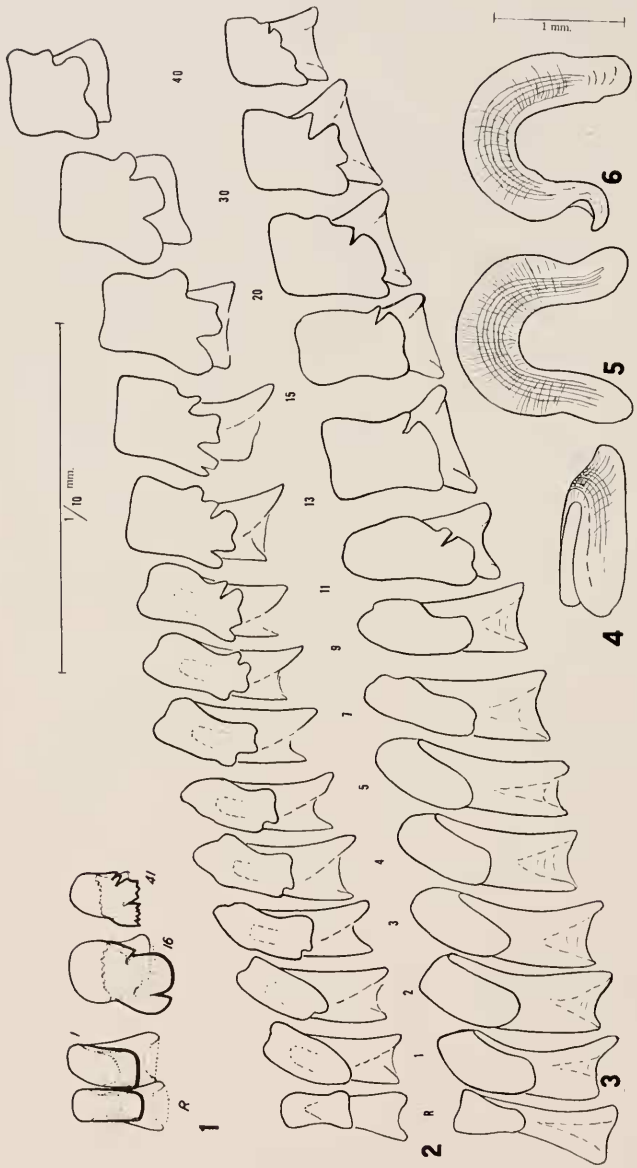


Plate 30

Radula and jaws of *Hemitrochus*.

Fig. 1. Radula of *Hemitrochus argutiferus* von Martens from Baker, 1943, Nautilus **56**, pl. 11, fig. 21, where it was published as *Cepolis* (*Jeanneretia?*) *dermatina* Shuttleworth (see Plate 27). Fig. 2. *Hemitrochus clenchi* Turner, Holotype. Fig. 3. *Hemitrochus riveroi* Turner, Holotype. Figs. 4–6. Jaws of *Hemitrochus riveroi*. Fig. 4, side view. Fig. 5, dorsal view. Fig. 6, ventral view. All drawings made with the aid of a camera lucida.

straight sided and sharply keeled; slightly concave above the keel and slightly convex below. Spire extended and produced at an angle of about 80°. Aperture ovate, depressed slightly downward, and produced at an angle of about 42° from the base. Palatal lip thin, narrow, white and slightly reflected. Parietal wall thinly glazed. Columella short, not noticeably thickened and curving into the base of the outer lip. Suture well marked but not impressed. Axial sculpture consisting of fine growth lines which become coarser on the later whorls. Spiral sculpture consisting of numerous fine and somewhat irregular threads. Nuclear whorls 1¼ and smooth. Mantle a rather uniform light chocolate-brown with a dark brown subperipheral stripe. Foot light brown, darkening posteriorly.

greater diameter	lesser diameter	height	whorls	
20 mm.	18.5 mm.	16 mm.	5¼	Holotype
21	19.5	19	5¼	Paratype
20	18.2	18	5⅛	"
18.5	17.5	16	5⅛	"

Types. The holotype is in the Museum of Comparative Zoölogy, no. 216144 from Cerro Doña Juana, Toro Negro National Forest, Puerto Rico. Paratypes from the same locality are in the Museum of Comparative Zoölogy, no. 216145.

Remarks. This is an extremely thin and fragile species. It is closely related to *Hemitrochus anguliferus* von Martens from which it differs by being much larger, having a higher spire, and having the whorls slightly concave above the keel. From *Hemitrochus dermatinus* Shuttleworth, and *H. clenchi* it is readily separated by its sharp keel and larger size.

Hemitrochus riveroi Turner is known only from the type locality. It was collected in the rain forest at night; the five specimens were on two adjacent palm trees crawling on the underside of the fronds at a height of about 10 feet.

The anatomy of the reproductive organs of *riveroi* is close to that of *H. anguliferus* von Martens, though the spermatheca duct is shorter and more slender. There were no gelatinous swellings at the apical end of the uterus and the five lobes of the ovotestis were far more closely packed. The ovotestis was deeply embedded in the digestive gland and difficult to dissect. See remarks under *H. anguliferus* von Martens.

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